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PATENT SPECIFICATION

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(19)

(54) METHOD AND APPARATUS FOR MAKING A STRIP OF FASTENERS

(71) We, TOLWOOD MULTIFASTNERS LIMITED, a British Company, of Coatham Avenue, Aycliffe Industrial Estate, Near Darlington, County Durham, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to pre-orientated fastners and has particular application to a method and apparatus for making a strip of pierce nuts, capable of being rolled into a coil.

In our British Patent Specification No. 1,358,099 there is disclosed a method of forming a strip of nut fasteners, pre-oriented for installation in a panel, which comprises the steps of forming a continuous bar of metal having a cross section conforming to the cross section of the nut fasteners to be formed, forming individual separated nut fasteners from said continuous bar, and joining said individual nut fasteners in oriented serial alignement by readily frangible connector means connecting adjacent fasteners to one another. In the preferred embodiment disclosed in said patent specification No. 1,358,099 the frangible connector means comprise spaced parallel wires, extending longitudinally of the strip of fasteners and embedded in grooves in each fastener.

Thus, for pierce nuts connected into a strip in accordance with the preferred embodiment disclosed in our Patent Specification No. 1,358,099, it is necessary for the nuts to have grooves cut into the face remote from the pilot portion of the nut and the grooves may be preformed in the strip of stock bar from which nuts are to be formed or cut in the nut after the nut has been formed. It then becomes necessary to locate the wires in the grooves of successive nuts to form a strip and for the wires to be secured in the nuts by, for example, knurling the grooved nut surface to reduce the width of the grooves of said surface.

The present invention seeks to provide a method of forming a strip of fasteners pre-orientated for installation in a panel and wherein the fasteners can be connected together without requiring working of the fastener surface to retain said means.

According to the present invention there is provided a method for forming a strip of fasteners, pre-orientated for installation in a panel, comprising the steps of forming a continuous strip of metal having a cross section conforming to the cross section of the fasteners to be formed, separating the fasteners from said continuous strip, and joining said fasteners in oriented serial alignment by attaching each fastener individually to at least one elongate metal member by a fused metal to metal bond therebetween.

Preferably two elongate metal members are provided and said members are arranged in spaced parallel relationship to extend in the direction of the strip of fasteners. When the fasteners comprise nuts, the metal member or members are preferably attached to the outer or free end face of each nut and spaced from the threaded bore of the nut to avoid interference when a threaded member is engaged in the said threaded bore.

The elongate metal member may be attached directly to a free plane face of each individual fastener or may be located in a groove or recess in a free plane face of the fastener.

Preferably the metal to metal bonding of each fastener to the elongate metal member or members is effected by welding, conveniently spot welding. Alternatively the bonding may be effected by soldering or brazing the individual fasteners to the elongate metal member or members.

The present invention also envisages apparatus for forming a strip of fasteners, pre-orientated for installation in a panel,

and comprising means for assembling a plurality of fasteners in end to end orientated relationship, means for depositing one or more elongate metal strips on the assembled fasteners, and heat treatment means for applying heat to the or each metal strip and fasteners located therewith to secure the fasteners to the or each elongate metal strip by a fused metal to metal bond therebetween.

Preferably the means for assembling the individual fasteners in end to end oriented relationship comprises a guideway for the fasteners and driving means for advancing fasteners in said guideway in end to end relationship to and past the heat treatment means. Conveniently the said driving means advance the fasteners in step by step manner, each step being equal to the length of a fastener in the direction of the nut strip and conveniently the heat treatment means are effective to bond a fastener to the strip during each dwell period of the drive means. Alternatively the drive means may advance assembled fasteners by more than one fastener length during each displacement movement and the heat treatment means are effective to bond all the fasteners advanced thereto during each dwell period.

In a further embodiment the heat treatment means are arranged to operate continuously on the assembled fasteners supplied thereto and the drive means advance the fasteners at a uniform speed to and from the heat treatment location.

The metal member is preferably in strip form and may be mounted on a reel, unwound therefrom, and deposited on the assembled fasteners before the fasteners and overlying metal strip pass to the location of the heat treatment means. When more than one metal member is to be bonded to the fasteners the reels may be located in side by side relationship and passed over guide rollers so as to be located in spaced parallel relationship on the assembled fasteners.

The heat treatment means may conventiently comprise electrodes, one above the overlying metal member and the other beneath the nut, and the electrodes are connectable to an electrical supply source sufficient to effect the desired heat treatment when the electrodes are operable.

In one embodiment in accordance with the invention the electrodes are arranged for relative displacement perpendicular to the direction of displacement of the assembled fasteners and means are provided for opening the electrodes, to permit the assembly of fasteners to pass therebetween during displacement movements of the fasteners, and for closing the electrodes to permit the electrodes to be operable during dwell periods of the assembled nuts.

The invention will now be described further by way of example with reference to the drawings accompanying the Provisional Specification, in which drawings:—

Fig. 1 shows a perspective view of a strip of pierce nuts assembled in accordance with the present invention;

Fig. 2 shows, diagrammatically, apparatus for welding individual nuts to elongate metal members to form a strip of nuts; and

Fig. 3 shows a cross section through an alternative arrangement for a strip of nuts.

The particular fastener shown in the drawings comprises a multi-purpose pierce and clinch nut having a substantially rectangular head or body portion 11 with a pilot portion 12 integral therewith. The individual nuts are severed from a strip of metal having a cross section identified by reference "A" and thus the length of pilot portion 12 is identical with the length of the head or body portion 11. The cross section "A" is defined for each nut by a plane top surface 13, side faces 14 and 15 and undersurfaces 16 and 17 which define abutment shoulders for the head or body portion 11. The pilot portion is defined by side walls 18 and 19, which have recesses or grooves 20 and 21 respectively therein, side faces 22 and 23 which define the width of the pilot portion, and an underface 24 which defines the piercing face for the nut. The bore 25 in each nut may conveniently be stamped or drilled in the strip of metal before the nut lengths are severed therefrom and said bores may be tapped before or after the nut length severance operation.

As is clearly illustrated in Fig. 1 the strip of nuts comprises nuts 26 bonded to two elongate metal strips 27 and 28 by spot welding, the welding locations being identified by reference "W".

In use, the strip of nuts is fed to a press and the end nut of the strip is located beneath a punch with its pilot portion 12 remote from the punch and aligned with a die having a die cavity for receiving the pilot portion 12. A sheet to which the end nut is to be attached is located above the die and the punch is then advanced towards the die to first sever the strips 27 and 28 in the plane between the end nut and the next to end nut and then to drive the separated nut against the panel so that the piercing face 24 of the pilot portion engages the sheet. As the panel further advances the peripheral edge of the piercing under face 24 cooperates with the peripheral edge of the die cavity to sever from the panel a slug conforming to the shape of the piercing face 24 and the pilot portion 12, pushing the severed slug before it as it enters the die cavity. During the last part of the downward displacement movement of the panel and nut 26 the abutment shoulders 16 and 17 of the head or

body 11 engage the sheet to prevent further penetration therethrough and the edge regions of the die cavity parallel with sides 22 and 23 of the pilot portion deflect sheet material adjacent the edges of the opening into the grooves 20 and 21 so that the nut 26 is retained with the sheet. Thereafter the punch is retracted to permit the sheet with the nut 26 affixed thereto be removed and when the punch has fully returned the strip of nuts is advanced to locate the end nut beneath the punch ready for the next stroke. It may be noted in this connection that when a nut is attached to a panel, the surface 13 is at the end of the nut remote from the panel and thus may be regarded as being the free or outer end surface of the nut, accordingly, it may also be regarded as constituting a free plane surface thereof.

In the apparatus illustrated in Fig. 2 for forming a strip of nuts, separated nuts 26 are fed in orientated end to end relationship from an inclined chute 30 to a guideway 31 by a rotatable disc 32 which presents radial members 33 equally spaced about its periphery. The end region of chute 30 and the start of guideway 31 have openings therein to permit radial members 33 to enter into engagement with the lowest nut 26 in the chute 30 and maintain the engagement until the nut 26 is located in the first position in guideway 31. The disc 32 is rigidly mounted on a rotatable shaft 34 and has a ratchet wheel 35 secured for rotation therewith, the number of teeth on ratchet wheel 35 being equal to the number of radial members 33 on disc 32.

The ratchet wheel 35 is engageable by a pawl 36 pivotally attached to a pin 40 mounted eccentric to the axis of a cam 41. The cam 41 is secured on the drive shaft 42 of an electric motor 43 whereby the cam 41 can be rotated at constant speed.

The guideway 31 directs the assembled nuts thereon between a pair of fixed bottom electrodes 44 and a pair of displaceable electrodes 45. Each electrode 45 is supported by a piston rod 46 of a double acting piston 47 slidably displaceable in a cylinder 48, and conduits 49 and 50 are provided for supplying pressure air from a pressure air source (not shown) to, and exhausting air from, the upper and lower unswept volumes respectively of cylinder 48. The porting of air to and from the cylinder 48 is controlled by a valve 51 which has an actuating member 52 in the form of a cam follower which follows the configuration of the periphery 53 of cam 41.

Two reels 54 and 55 carrying metal strips 27 and 28 wound respectively thereon are rotatably supported in side by side relationship above the guideway 31 and the metal strips 27 and 28 unwind from reels 54 and 55 and pass beneath a roller 56 which deposits the two strips 27 and 28 on the assembled nuts and locates the two strips 27 and 28 in spaced parallel relationship on the continuous surface presented by the surfaces 13 of the assembled nuts.

The above described apparatus operates as follows.

With an assembly of nuts 26 in end to end relationship on guideway 31 and a supply of nuts 26 on chute 30 ready to enter the guideway 31, with the electrodes 45 elevated and with motor 43 activated to rotate cam 41 at constant speed, a displacement of the assembled nuts towards the right, as viewed in Fig. 2, is initiated when cam 41 acts through eccentric pin 40 to displace and cause pawl 36 to engage a tooth on ratchet wheel 35 to cause angular displacement of said ratchet wheel, shaft 34 and disc 32 in a clockwise direction. As disc 32 rotates clockwise a radial member 33 engages in the tapped bore 25 of the lowest nut on chute 30 and advances said nut into the first nut position on slideway 31, the introduction of said nut to slideway 31 causing the column of nuts on said slideway to be displaced by one nut length.

At the completion of a displacement movement of the nuts on guideway 31, cam 41 causes pawl 36 to be displaced towards the left ready for engagement with the next tooth on ratchet wheel 35. A non-return pawl 57 engages the ratchet wheel 35 to prevent anticlockwise displacement of ratchet wheel 35 and disc 32, so that during the static period of ratchet wheel 35, the radial member 33 engaged in the bore of the nut in the first position on guideway 31 can retain said nut, and thereby the nuts forward thereof, against displacement towards the left as viewed in Fig. 2.

The period when pawl 36 is not rotating ratchet wheel 35 thus constitutes a "dwell" period for the nuts on guideway 31 and as cam 41 rotates to displace pawl 36 towards the left the cam periphery 53 displaces the actuating member 52 of valve 51 to cause valve 51 to changeover.

When valve 51 switches, the conduit 50 is opened to atmosphere and conduit 49 is connected to a pressure air supply so that electrodes 45 are lowered into contact with the strips 27 and 28, electrical current is supplied to the electrodes 45 and 44 from a power source (not shown) by way of cables 57 and 58 respectively and the flow of current between the pairs of electrodes 44 and 45 causes heating currents to flow through the engaged nut and the metal members 27 and 28 to spot weld members 27 and 28 to the engaged nut.

The supply of electrical current to electrodes 44 and 45 may be effected by any known means but is preferably arranged on a time-sequence initiated by the downward

displacement of electrode 45 and completed before the electrodes 45 are elevated.

The welding operation is thus performed during the movement of pawl 36 towards the left and as the cam 41 continues rotating to terminate movement of pawl 36 towards the left and initiate displacement towards the right the peripheral track 53 on cam 41 permits the cam follower, defined by valve actuating member 52, to return towards the rotational axis of the cam whereby valve 51 is again actuated and the supply and exhaust of air to the unswept volumes of cylinder 48 are reversed so that the piston 47, piston rod 46 and electrode 45 are elevated. Continued rotation of cam 41 causes pawl 36 to engage and cause clockwise rotation of ratchet wheel 32 to rotate a radial member 33 clockwise which thereby advances the lowermost nut in chute 30 into the guideway 31 and, in advancing the nuts on guideway 31, presents a new nut 26 between the electrodes 44 and 45.

As the strips 27 and 28 are welded to the nuts by electrodes 44 and 45 the advance of the nuts on guideway 31 causes the strips 27 and 28 to advance and unwind from the reels 54 and 55, respectively, so that it is not necessary to provide a separate drive for the strips 27 and 28.

As the nuts welded to the strips 27 and 28 leave the guideway 31 they pass beneath a guide roller 59 and are wound onto a reel 60 which may be driven by a friction clutch (not shown). When a sufficient length of nut strip has been wound onto the reel 60 the length is separated at a desired junction between two nuts by severing the strips 27 and 28 at said junction, the filled reel 60 is removed and a new reel, for receiving newly formed nut strip, assembled with the apparatus.

The separated nuts 26 shown in Fig. 1 have plane top surfaces 13 and the metal strips 27 and 28 are welded directly to the top surfaces 13 but the invention is not limited to such nuts and Fig. 3 shows an alternative nut and strip form for a strip of nuts. In the Fig. 3 embodiment the nut 61 has rectangular grooves or recesses 62 in its upper surface 63 and the metal strips, such as strips 27 and 28, are located in the recesses 62 and welded therein. Conveniently the depth of the recesses 62 from surface 63 is equal to the thickness of the strips 27 and 28 so that, when assembled, the nuts 61 and metal strips 27 and 28 present a substantially flat plane upper surface for the assembly.

Although the invention has been described by way of example with reference to spot welding it will be apparent to persons skilled in the art that the metal to metal bonding of a nut to a metal member can be effected by a continuous welding of the metal member to the nut or by a soldering or brazing of the nut to the metal strip. When the bond is to be effected by soldering or brazing a strip of solder or brazing material can be fed between the metal member and the nut, conveniently from a reel or reels of such material, or the metal member may be pretreated to introduce the intermediate metal against the nut. The requirements, apparatus and method for performing the invention by continuous welding, soldering, or brazing, as substitutes for the spot welding operations described herein will be apparent to persons skilled in the art.

WHAT WE CLAIM IS:—

1. A method of forming a strip of fasteners, pre-orientated for installation in a panel, by forming a continuous strip of metal having a cross section conforming to the desired fastener cross section, separating the fasteners from the continuous strip, and subsequently joining the separated fasteners together in orientated serial alignment by attaching each fastener individually to at least one elongate metal member by a fused metal to metal bond therebetween.

2. A method as claimed in claim 1, wherein two elongate metal members are provided and are arranged in spaced parallel relationship to extend in the direction of the strip of fasteners.

3. A method as claimed in claim 1 or 2, wherein the fasteners are nuts, and the metal member or members are attached to the outer or free plane end face of each nut and are spaced from the threaded bore of the nut to avoid interference when a threaded member is engaged in the threaded bore.

4. A method as claimed in claim 1, 2 or 3, wherein the or each elongate member is located in a groove or recess in a free plane face of the fastener prior to effecting metal-to-metal bond therebetween.

5. A method as claimed in claim 1, 2 or 3, wherein the or each elongate metal member is attached directly to a free plane face of each individual fastener.

6. A method as claimed in any one of claims 1 to 5, wherein the metal-to-metal bonding of each fastener to the or each elongate member is effected by welding, soldering or brazing.

7. Apparatus for forming a strip of fasteners, pre-orientate for installation in a panel, and comprising means for assembling a plurality of fasteners in end-to-end orientated relationship, means for depositing one or more elongate metal strips on the assembled fasteners, and heat treatment means for applying heat to the or each metal strip and fasteners located therewith to secure the fasteners to the or

each elongate metal strip by a fused metal-to-metal bond therebetween.

8. Apparatus as claimed in claim 7, wherein the heat treatment means is associated with driving means for advancing fasteners past the heat treatment means.

9. Apparatus as claimed in claim 8, wherein the driving means advance the fasteners in end-to-end relationship up to and away from the heat treatment means in step-by-step movements, each movement being equal to the length of a fastener or a multiple thereof, the heat treatment means operating to effect the metal-to-metal bond of the metal strips to one or more fasteners during dwells in the advancing movement.

10. Apparatus as claimed in claim 8, wherein the driving means advance the fasteners in end-to-end relationship continuously up to and away from the heat treatment means which operate continuously.

11. Apparatus as claimed in any one of claims 7 to 10, wherein the heat treatment means comprises electrodes above the overlying metal strips and beneath the fasteners, and connectable to an electrical supply source.

12. Apparatus as claimed in claim 11 when dependent on claims 7 to 9, wherein the electrodes are arranged for relative displacement perpendicularly to the direction of movement of the assembled fasteners and metal strips, and are advanced towards and retracted from the fasteners and metal strips during dwell periods of the progression of the fasteners and metal strips through the apparatus.

13. A method of forming a strip of fasteners pre-orientated for installation in a panel substantially as herein described with reference to the drawings accompanying the Provisional Specification.

14. Apparatus for forming a strip of fasteners pre-orientated for installation in a panel substantially as herein described with reference to and as illustrated in the drawings accompanying the Provisional Specification.

15. A strip of fasteners formed by the method of any one of claims 1 to 6 and 13 or by the apparatus of any one of claims 7 to 12 and 14.

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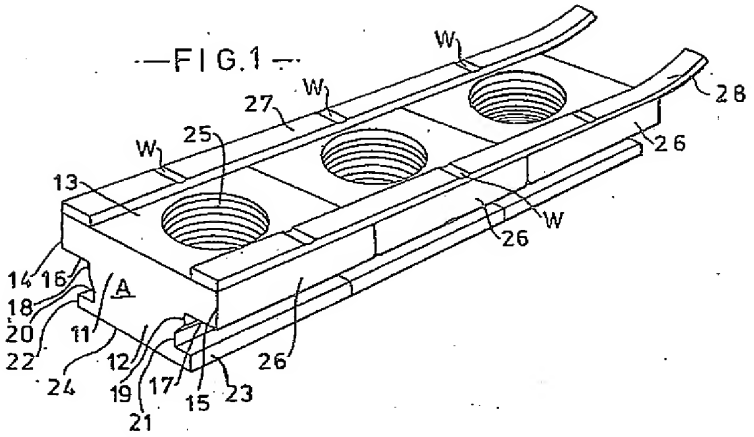
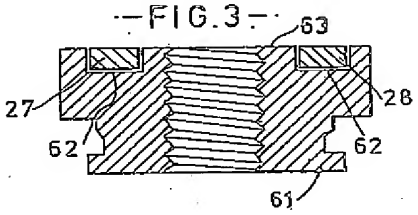
Sheet 1

—FIG.1—



—FIG.3—



1472751 PROVISIONAL SPECIFICATION
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Sheet 2

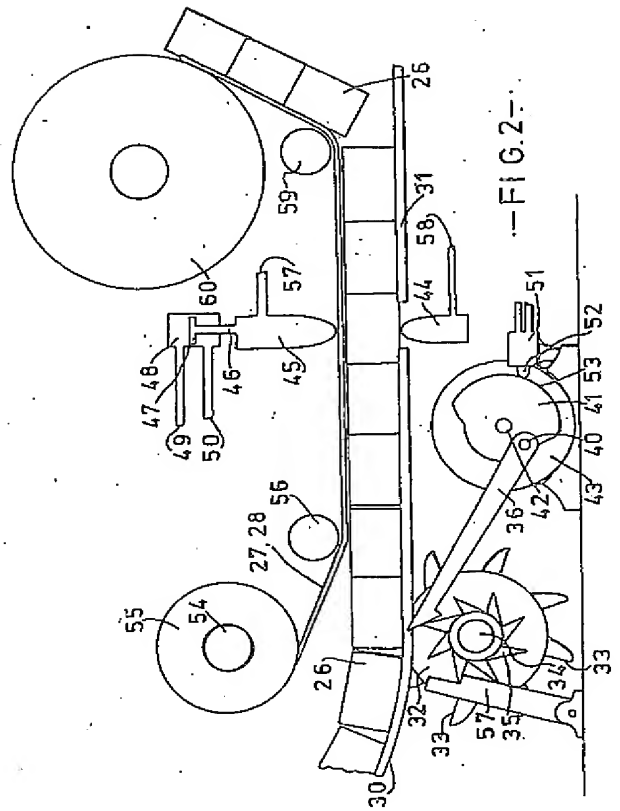

FIG.2.